

## Current Assessment of Choledochoduodenostomy in the Management of Choledocholithiasis

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### Abstract:

**Background/Aim:** Choledochoduodenostomy (CDD) has been reported as an effective treatment of Choledocholithiasis. The risk of causing recurrent cholangitis led to a decline without detailed evidence for the same. There has been a renewed interest in CDD in the last three decades, with several publications carefully evaluating CDD. Aim of this study is to evaluate the outcome of CDD in the treatment of Choledocholithiasis and discuss its various other indications.

**Material and Methods:** This retrospective study was conducted at Government Medical College, Amritsar over a period of 2 years from July 2017 to July 2019. Twenty Five (25) consecutive patients undergoing CDD were included in the study. Pre-operative preparation was undertaken meticulously. The final decision on the choice of drainage procedure for the CBD was reserved till the patients were examined per-operatively and the investigation findings corroborated. Those patients with dilated CBD, multiple stones, biliary sludge or stone impacted in the lower end of CBD were selected for CDD. Patients were followed up for 6 months to study the outcome of surgery.

**Results:** Total of 25 patients underwent CDD. The mean age of patients was 49.36 yrs, 72% of them were females. The most common symptom on presentation was pain abdomen in 23 (92%) patients and jaundice was the 2<sup>nd</sup> most common symptom (64%). All patients who underwent CDD had CBD dilated  $\geq 10$ mm. 14 (56%) patients had single stone and 10 patients had two or more stones of which 4 had 3 or more stones. Morbidity was 84% with no mortality. Most common complication was wound infection (12%). One patient (4%) had bile leakage. All patients were discharged in satisfactory condition. The average post-operative hospital stay was 7 days. 96% patients had no complaints at 6 months. There was no case of cholangitis and retained/recurrent stones.

**Conclusion:** Choledochoduodenostomy is a safe, fast, effective and simple procedure. CDD still has its place in the management of Choledocholithiasis in spite of the development of endoscopic procedures and the trends of minimally invasive approaches to this pathology.

**Key Words:** CBD, CDD, Choledochoduodenostomy, Choledocholithiasis.

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### I. Introduction:

Common bile duct (CBD) stones may occur primarily along with gall bladder stones or many years after a cholecystectomy or be related to the development of new pathology, such as infection of the biliary tree or infestation by *Ascaris lumbricoides* or *Clonorchis sinensis*. Any obstruction to the flow of bile can give rise to stasis with the formation of stones within the duct. When not clinically silent, common duct stones may present with symptoms ranging from biliary colic to the clinical manifestations of obstructive jaundice, such as darkening of the urine, scleral icterus, and lightening of the stools. The treatment of CBD stones has shown considerable evolution over the last 4 decades. Treatment options for these stones include endoscopic retrograde

cholangiopancreatography (ERCP), CBD Exploration and Biliary drainage procedures. The factors that determine the optimal approach include the patient's age and general condition. It is also important to consider the local expertise of the surgeon and the gastroenterologist in managing CBD stones. At present, endoscopic sphincterotomy is widely accepted as the treatment of choice for patients with CBD stones and subsequent laparoscopic Cholecystectomy.<sup>1</sup> Acute Pancreatitis and recurrent/retained CBD stones are one of the most frequent complications after ERCP procedures. Choledochoduodenostomy (CDD), originally described by Reidel<sup>2</sup> in Europe in 1888, is a drainage procedure. It reduces the chance of recurrent stones and due to separation of insertion of CBD and Pancreatic duct the precipitating factor of Bile Stone Pancreatitis is also eliminated. Sprengel was the first to perform successfully CDD in 1890.<sup>3,4</sup> Choledochoduodenostomy is undertaken for many indications, including failure of clearance of distal CBD stones during common duct exploration, multiple large or primary CBD stones, and benign biliary strictures. In this study we review Choledochoduodenostomy performed in 25 patients for choledocholithiasis over a period of 2 years and evaluate the outcome in our centre.

## **II. Materials And Methods:**

The study was conducted in the Department of Surgery, Government Medical College, Amritsar between July 2017 to May 2019. Twenty Five (25) consecutive patients undergoing choledochoduodenostomy were included in the study. Appropriate permission was taken from institutional ethics committee. Patients who gave informed consent were included in the study. All the patients underwent routine investigative protocol. Diagnosis of bile duct pathology was established primarily by Liver Function Test (LFT) and Ultrasonography (USG) in all cases. CECT scan or/ and Magnetic Resonance Cholangiopancreatography (MRCP) whenever necessary for diagnostic purpose in any of the patients was sought. Pre-operative preparation was undertaken meticulously with particular emphasis on prevention of bleeding tendencies and renal impairment. The final decision on the choice of drainage procedure for the CBD was reserved till the patients were examined per-operatively and the investigation findings corroborated. Those patients with dilated CBD, recurrent/retained stones, multiple stones, or stone impacted in the lower end of CBD were selected for CDD. A right subcostal incision was given and cholecystectomy was performed. If cholecystectomy performed in the past, the incision was made in the area of the previous operation. The duodenum was widely mobilised by generous Kocher manoeuvre so that it can be approximated to the CBD without tension. Two traction sutures were applied on either side of the mid line in the anterior wall of CBD by Delayed Absorbable Suture. A 2.5 cm longitudinal incision was made in the distal CBD as close as possible to the area of stenosis or obstruction in patients with benign diseases. Stones were removed from the bile duct using Desjardin's Choledocholithotomy forceps. Bile duct was irrigated with saline to clear any residual stones or debris. The duodenum was opened longitudinally for a distance of 2.5 cm. A traction suture was passed through the mid-portion of the incision in the duodenum and lower angle of the incision in the CBD. Other 2 traction sutures were passed through either end of the duodenal incision. Anastomosis was done with interrupted suture using Delayed Absorbable Suture. Interrupted suture at 2-3mm interval was taken between the duodenum and the bile duct forming the posterior wall. Sutures were secured by a traumatic clamp until the row was completed. All sutures were tied and then cut except the angle sutures. A final row of interrupted Delayed Absorbable sutures completed the anterior anastomosis. Abdomen was closed after placing Sub-Hepatic Drain.

## **III. Results:**

A total of 25 patients were included in this study. The youngest patient was 32 yrs old and the oldest was 70 yrs old. The mean age of patients included in this study was 49.36 yrs. 18 (72%) female and 7 (28%) male patients underwent choledochoduodenostomy. The male to female ratio was 2.57:1 (F: M)(TABLE I AND II). The most common symptom on presentation in our study was pain abdomen 23 (92%) patients. Jaundice was the 2nd most common symptom and was present in 16 (64%) of the patients. Nausea/Vomiting was present in 28% of patients. Pruritis and Vomiting was present in 20% of patients. The history suggestive of Cholangitis (Charcot's triad) was present in 12% (3/25) of patients. None of the patients who underwent CDD were asymptomatic (TABLE III). The liver function tests including Serum Bilirubin, SGPT and Serum Alkaline Phosphatase (ALP) were elevated in 16 (64%), 17 (68%) and 19 (76%) patients respectively. All 25 of our patients underwent USG abdomen. 4 patients had post-cholecystectomy status. 6 patients needed MRCP for final diagnosis (TABLE IV, V, VI). All other patients who underwent CDD had CBD dilated  $\geq 10$ mm. 14 patients (56%) had single stone and 10 patients had two or more stones of which 4 had 3 or more stones (TABLE VII). There was no stone detected in 1 patient who presented to us with T-tube in-situ with its proximal limb out of CBD after 6 weeks of CBD exploration. T-tube was removed and anastomosis done after extending the stoma upward and downward. A patient with history of ERCP with stenting 1 year back had the stent removed along with stones during surgery. The average over post-operative hospital stay was 7 days. Total of 4(16%) patients had post-operative complications. The most common complication in our study was wound infection and was

found in 3 (12%) patients. All 3 of the patients were managed with regular aseptic dressing. One patient (4%) had bile leakage. Bile leak was managed conservatively. No intervention was required and resolved spontaneously. No other complication was present (TABLE VIII). Overall there was 84% morbidity with no mortality. All patients were discharged in satisfactory condition. Three (12%) patients had complaints at 6 weeks follow-up. 1 patient had both symptoms of dyspepsia and pain. 1 patient presented with pain at wound site and 1 patient had complaint of dyspepsia. Four percent (1/25) of the patients complained of pain at incision site after 6 months.

**TABLE I: SHOWING AGE DISTRIBUTION**

AGE (YEARS)	NO. OF CASES	PERCENTAGE
<40	6	24.00
41-50	10	40.00
51-60	6	24.00
>60	3	12.00
TOTAL	25	100.00

**TABLE II: SHOWING SEX DISTRIBUTION**

Age (Years)	No. of Cases	Percentage
Female	18	72.00
Male	7	28.00
Total	25	100.00

**TABLE III: SYMPTOMATOLOGY**

Symptom	No. of Cases (n=25)	Percentage (%age)
Pain	23	92.00
Jaundice	16	64.00
Nausea/Vomiting	7	28.00
Pruritus	5	20.00
Fever	5	20.00

**TABLE IV: ULTRASOUND ABDOMEN FINDINGS**

CBD Size (mm)	No. of cases (n=24)*	Percentage (%)
7-10mm	3	12.5
11-15	9	37.5
16-20	6	25
>20	6	25

(\*USG did not comment on size of one patient having T-tube in-situ)

**TABLE V: ULTRASOUND ABDOMEN FINDINGS**

CBD Calculi (Numbers)	NO. OF CASES (N=25)	PERCENTAGE (%)
No Calculi	5	20%
1	13	52%
2	3	12%
≥3	4	16%

**TABLE VI: MRCP**

MRCP FINDINGS	NO. OF CASES (n=6)
CBD Diameter(mm)	
15-17	2
18-20	2
≥20	1
CBD Stones(No.)	
1	2
2	3
≥2	0

**TABLE VII: OPERATIVE FINDINGS (CBD CALCULI)**

CBD FINDINGS	NO. OF CASES (n=25)	PERCENTAGE (%)
CBD CALCULI (no.)		
1	14/25	56.00
2	6/25	24.00
≥3	4/25	16.00

**TABLE VIII: POST-OPERATIVE COMPLICATIONS**

COMPLICATIONS	NO. OF CASES	PERCENTAGE (%)
Biliary Leakage	1	4.00
Wound Infection	3	12.00
Septicaemia/Cholangitis	-	-
Intra-abdominal abscess	-	-
Recurrent/retained stones	-	-
TOTAL	4	16.00

#### IV. Discussion:

Benign biliary obstructive diseases constitute the group of most common biliary diseases after gall bladder calculosis. Choledochoduodenostomy, first successfully performed by Sprengel in 1891, still has its place in the management of choledocholithiasis in spite of the development of endoscopic procedures and the trends of minimally invasive approaches to this pathology. CDD is technically simple, fast to perform, effective and safe alternative.

In everyday clinical practice, it is most commonly used in the elderly, those at higher surgical risks with distal (retropancreatic or supraduodenal) stenoses (Chronic Pancreatitis, injuries, inflammations), those with calculi stuck in the papilla as well as in patients with multiple, residual or recurrent calculosis. In addition to the above indications, CDDs can be applied as well after unsuccessful endoscopic procedures [endoscopic papillotomy (EPT), stenting] and in the cases when these are not available.<sup>3,5,6,7,8,9</sup> Low injuries of the bile duct can be re-implanted into duodenum.<sup>10</sup> In malignant lower bile-duct obstruction, this operation may be used as an alternative to choledochojejunostomy in patients in whom the gall-bladder has previously been removed, or where the cystic duct joins the common bile-duct low down.<sup>11</sup> Study has been published where bile duct reconstruction during liver transplantation by choledochoduodenostomy was performed successfully as an alternative to choledochojejunostomy.<sup>12</sup>

A total of 25 consecutive patients were included in the study. The mean age of patients in this study was 49.36 yrs. The male to female ratio was 2.57:1 (F: M). The most common symptom on presentation in our study was pain abdomen. Jaundice was the 2nd most common symptom. These findings were similar to study by Leppard et al (2010).<sup>13</sup> In patients who underwent Choledochoduodenostomy, serum bilirubin was raised in 64% of them. SGPT and Serum Alkaline Phosphatase (ALP) were elevated in 68% and 76% respectively.

Four patients had post-operative complications. All 4 (16%) patients with complications had either Clavien-Dindo Grade I or Grade II.<sup>14</sup> Three patients had Grade I complication while one patient had Grade II complication. Post-operative morbidity after CDD is acceptable, reported as ranging from 9.8% to 28%<sup>15,16,17</sup> in various studies and consistent with the 16% in this study and comparable to 17% as reported by Leppard et al<sup>13</sup> and less than 23.33% reported by Malik et al.<sup>8</sup> The most common complication was wound infection seen in 12% (3/25) of the patients. Of the 3 patients with wound infection 2 patients had diagnosis of Type-2 Diabetes Mellitus. Complication of wound infection in our study was comparable to study by Khalid et al<sup>18</sup> where wound infection was the commonest complication (11%). In a study by Leppard et al 20% patients had wound infection while wound infection was seen in 9.5% of the patients in study by Srivengadesh G et al.<sup>13,19</sup> Anastomosis related complication was seen in only 1 patient (4%), who had bile leakage. Results in study of 21 patients by Srivengadesh G et al showed comparable results with anastomotic leakage and peritonitis seen in 1 (4.8%) patient.<sup>19</sup> In study by Leppard et al, biliary leakage was found in 13% of the patients.<sup>13</sup>

Cholangitis, classically presenting as Charcot's triad, was observed in none of our patients during the study period. The long-term results in the largest series of CDD regarding the appearance of cholangitis show an incidence ranging from 0 to 6%.<sup>8,13,20,15,21,22,23</sup> For a long time cholangitis was thought to be due to ascending reflux from the duodenum toward the biliary tree, but this etiology has been refuted by experiments on dogs and by clinical data.<sup>3,4,24</sup> At the present time stenosis of the anastomotic stoma is thought to be the major factor responsible for this complication. A wide-enough anastomosis allows entrance and exit of bile and duodenal contents, thereby avoiding stasis and stone retention. Our study agrees with de Almeida et al who thought that a dilatation exceeding normal values ( $\geq 10\text{mm}$ ) is sufficient for a wide CDD to be created.<sup>25</sup> In addition to a wide CBD, interrupted sutures are employed to avoid compromising the blood supply to the bile portion of the anastomosis, which is important for preventing stenosis.<sup>26</sup> Recent studies like Srivengadesh et al<sup>19</sup>, Leppard et al<sup>13</sup> and El Nakeeb et al<sup>21</sup> have reported 0% complications of Cholangitis and studies by Uchiyama et al<sup>27</sup>, Bosanquet et al,<sup>28</sup> Malik et al<sup>8</sup> and Luu et al<sup>29</sup> reported Cholangitis complications from 1-3%.

Our study did not reveal the complication of intra-abdominal abscess. Various studies have reported incidence of intra-abdominal abscess with variable incidence.<sup>20,30,31</sup> Abdelmajid et al<sup>30</sup> had 1 (2%) patient with complication of intra-abdominal abscess while Gavini et al<sup>31</sup> had 2 (4%) patients with multiple liver abscesses. There was no case of recurrent or retained stone which is consistent with various other studies by Gupta BS<sup>32</sup>, Srivengadesh G et al<sup>19</sup> and Okamoto et al<sup>20</sup>. Following exploration of bile duct and T-Tube drainage 7 to 10% patients develop symptoms due to residual or recurrent stones.<sup>32</sup> Higher recurrence rates are reported

with choledochotomy and T-tube drainage because of unchanged biliary structure which keeps CBD environment prone to stone formation.

No patient reported of Sump Syndrome. Sump syndrome is defined as cholangitis, hepatic abscess or pancreatitis after side-to-side CDD due to the pooling of sludge or debris in the blind pouch created in terminal CBD. Enteral reflux, stenosis of the papilla of Vater, wide distal choledochus, residual calculosis, inadequate stoma size and shape (such as kinking, resulting in poor biliary drainage and hampering irrigation of the blind segment of choledochus) are one of the major factors in the onset of the syndrome.<sup>33</sup> None of the series published by Madden<sup>3</sup>, Stuart and Hoerr<sup>34</sup>, Thomas<sup>35</sup>, Degenshein<sup>24</sup> and Srivengadesh<sup>19</sup> have recorded complication attributable to Sump syndrome. Some studies had reported a prevalence of 0–9.6%<sup>3,36,37</sup> while more recent studies have reported a prevalence of 0–5.2%.<sup>8,13,15,16,20,21,22,23,25,27,28,29,30,38,39,40</sup> The primary treatment of sump syndrome due to stomal stricture is endoscopic balloon cholangioplasty. Caroli-Bosc and colleagues described their experience with 30 patients with sump syndrome managed endoscopically. All patients in their series underwent successful endoscopic management.<sup>13,41</sup> No patient had symptoms suggestive of cholangitis during our study period. There was no complication of Pancreatitis seen. After choledochoduodenostomy due to separation of insertion of CBD and Pancreatic duct the precipitating factor of bile stone pancreatitis is eliminated. In a Cochrane review from 2013, 16 randomised clinical trials with a total of 1758 patients were examined, comparing laparoscopic and open CBD exploration with ERCP in the management of CBD stones. There was no significant difference between these approaches, in both morbidity and mortality. However, open CBD exploration was associated with a higher clearance rate (94% vs. 84%)<sup>42</sup> The use of ERCP necessitates increased number of procedures per patient.<sup>43</sup>

## V. Conclusion:

Choledochoduodenostomy still has its place in the management of Choledocholithiasis as a simple, fast, effective and safe alternative, in spite of the development of endoscopic procedures and the trends of minimally invasive approaches to this pathology. Choledochoduodenostomy can be performed with good long term results if wide enough anastomosis (at least 2.5cm) can be created. Choledochoduodenostomy can be performed with success in patients with recurrent/retained stones after ERCP procedure or choledocholithotomy with T-tube. This procedure is also recommended for choledocholithiasis patients in whom other methods have failed. Choledochoduodenostomy reduces total cost and need for repeat procedures. Choledochoduodenostomy should be considered a method of choice in remote areas where facility for endoscopy is lacking and in patients where cost is a factor in deciding choice of procedure.

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